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STATION FOR PRODUCTION OF HYDROGEN AND OXYGEN UNDER PRESSURE BY ELECTROLYSIS OF WATER AT GREAT DEPTH, THEN TRANSFORMATION INTO ENERGY BY PROPULSION OF THE TWO GASES AND COMBUSTION OF THEIR MIXTURE

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STATION FOR PRODUCTION OF HYDROGEN AND OXYGEN UNDER PRESSURE BY ELECTROLYSIS OF WATER AT GREAT DEPTH, THEN TRANSFORMATION INTO ENERGY BY PROPULSION OF THE TWO GASES AND COMBUSTION OF THEIR MIXTURE

[Centrale de production d'hydrogene et d'oxygene sous pression par electrolyse de l'eau a grande profondeur puis de transformation en energie par propulsion des deux gaz et combustion de leur mélange]

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The present invention relates, on one hand, to devices for production and storage of /1*
hydrogen and oxygen, and on the other hand, to devices for production of energy by combustion of the hydrogen-oxygen mixture.

In the known devices of this type: On one hand, the production of hydrogen and oxygen by electrolysis of water requires a great expenditure of electrical energy. On the other hand, the storage of hydrogen and oxygen, as well as the production of energy by combustion of these two gases necessitates compression of them beforehand and therefore another great expenditure of energy. It results from all this that the energy necessary for the electrolysis of the water and for the compression of the hydrogen and oxygen is not recovered in a device which uses as motive element the combustion of a hydrogen-oxygen mixture under pressure. First, because the

* [Numbers in the right-hand margin indicate pagination in the original text.]

expenditure of energy necessary for these two operations is great, and then, because in the engines or reactors where the combustion of the hydrogen-oxygen mixture under pressure takes place, only the mechanical energy provided by the explosion of the mixture is used. The thermal energy is lost, unless a steam engine or turbine is available nearby in order to use this energy. The storage of these gases under pressure at ground level is very dangerous because in case of leakage, the hydrogen forms an explosive mixture with the air or oxygen. This storage requires the use of tanks or containers with very thick walls.

In the device which follows, the invention makes it possible to prevent these problems, since the electrolysis of the water takes place at great depths of water which allows one to give the hydrogen and oxygen thus produced under a diving bell the pressure predominating at these depths. For the device to be profitable, it is sufficient to produce the phenomenon at a sufficient depth for the level of compression of the hydrogen and oxygen to give a mixture whose combustion releases a quantity of energy greater than that necessary for the electrolysis of the water. Because of the great depths of the seas and oceans, it is possible to obtain very high levels of compression of the hydrogen and oxygen and therefore a very good profitability and an explosive mixture with a high energy capacity. Because these gases are produced and stored at great depth under the sea, the storage tanks can have walls which are not very thick, because although the pressure is very great, it is the same inside and outside of the tanks. On the other hand, because the storage tanks are situated at great depths under high pressure, and the reactors /2
where the hydrogen-oxygen mixture is burned are on the shore at atmospheric pressure. There occurs a phenomenon of acceleration of the movement of the molecules of the mixture, which, starting from the bottom of the body of water where a high pressure predominates, are as if sucked by the low pressure of the surface and accelerate their speed progressively during the long journey as they approach water level. Arriving in the combustion chamber, where this energy is added to that produced by the combustion of the mixture. In a device which makes it possible to recover and transform the energy produced by the explosion of the mixture. As well as the thermal energy resulting from its combustion.

The device to which the invention relates has a number of production elements equipped differently depending on whether one wishes to produce d.c. electrical current, a.c. electrical current, or hydrogen and oxygen under pressure. Each element has a double-cavity electrolysis bell which, depending on the direction of the electrical current, receives the hydrogen and oxygen produced by it around the two electrodes placed in each cavity and which are connected by two electrical cables to a source of d.c. electrical current situated on land. Each cavity of the electrolysis bell dumps its gas overflow into a submerged storage bell near it and shared by all the production elements. These two storage bells, one for the storage of hydrogen and the other for the storage of oxygen, are connected by two pipes to the reactor part situated on land and

they end in the combustion chamber. The hydrogen-oxygen mixture, by burning in this chamber, puts in motion, by its sudden expansion and speed, a turbine which drives an electrical current generator. The central part of this turbine sucks water by centrifugation and using a pipe which, by passing through the central part, cools the turbine. This water is then transformed into steam in the pipes arranged behind the blades of the turbine in order to recover the heat produced by the combustion of the hydrogen-oxygen mixture; arranged coming out of the pipes is another turbine also connected with the electrical current generator. The energy produced by the steam is exerted on the second turbine. In one production element, the generator produces d.c. electrical current which is used to supply the electrodes of the electrolysis bells of all the other production elements. The generators of the other production elements produce electrical current for /3
industrial use, d.c. current or a.c. current depending on their design. According to another execution, all the generators are designed and used for the production of d.c. current intended for the electrolysis of the water and therefore for the production of hydrogen and oxygen under /4
pressure for industrial use.

The appended drawings, plates 1, 2, 3, 4, illustrate as an example the execution of a device according to the present invention. As represented, each element includes: A part for production of hydrogen and oxygen under pressure, Figure 3, which has framework 1 resting on bottom 2 which supports electrolysis bell 3 made of insulating material with double cavities 4, 5, in the center of which two electrodes 6, 7 are arranged, which are connected by two electrical cables 8, 9 to a source of d.c. electrical current situated on the surface. Two pipes 10, 11 connect cavities 4, 5 to two large storage bells 12, 13 shared by all of the production elements, Figure 2. For each production element, two pipes 14, 15 connect tanks 12, 13 to the energy production part, Figure 4. This reactor has framework 16 attached on shore 17, making possible, by its bearing 18, the rotation of hollow shaft 19, one end of which 20 dips in water 21, whereas the other end 22, with interiorly grooved conical form 23, adopts the shape of conical end 24 of piece 25 which is connected with framework 16. End 22 is connected in its most flared part with central part 26 of turbine 27 whose very wide ring 28 supports another turbine 30 by four fins 29. Piece 25 supports on its periphery a set of pipes 31 placed between turbines 27 and 30 connected on circular tank 32 made up of the space between cylindrical part 33 of piece 25 and central part 26 of turbine 27, and opening in front of the blade of turbine 30. Combustion chamber 34 ensures the connection between ends 35 of the two pipes 14, 15 and, on one hand, ring 28, and on the other hand, central part 26 of turbine 27. Ignition device 36 is arranged in the vicinity of ends 35. Each of pipes 14, 15, provided with two valves 37, 38 for adjustment of their flow rate, has diversion 38, 40 provided with valve 41, 42 for industrial use of the gases. Hollow shaft 19 supports, in its central part, collector 43, armature 44 which turns in field winding 45 connected with framework 16. A set of two switches 48, 55 with two directions provides the various

connections between cables 8, 9, collector 43, the exterior source of d.c. current 46, and industrial users 47.

The functioning of the station is the following: In starting, electrodes 6, 7 are supplied by exterior source 46 by closing switch 48 on [contact] studs 49 and 50. Which brings about the electrolysis of the water and the accumulation of oxygen around positive electrode 6 (anode) in cavity 4 and hydrogen around negative electrode 7 (cathode) in cavity 5. When these cavities are full, the overflow of oxygen and hydrogen at the pressure exerted by water 21 at this depth escapes through pipes 10, 11, and the oxygen under pressure 51 is stored in storage bell 12, while the hydrogen under pressure 52 is stored in storage bell 13. When the quantity of hydrogen and oxygen under pressure is sufficient. The exterior source of d.c. current 46 is disconnected, and collector 43 is connected by tilting switch 48 on studs 53, 54 and switch 55 on studs 56, 57. With valves 41, 42 closed and valves 37, 38 open, the oxygen and the hydrogen under pressure arrive at high speed in combustion chamber 34 at several spots because the combustion chamber is circular, and pipes 14, 15 are branched at their ends 35. Ignition device 36 brings about the explosion of the mixture. The power of this added to the speed and to the pressure of the gases brings about the rotation of turbine 27 which, by the intermediary of hollow shaft 19 lead to. On one hand, the rotation of armature 44 in field winding 45 and therefore the production of d.c. electrical current which is collected by collector 43. This current, by the intermediary of switches 48 and 55, and then cables 8, 9, supplies electrodes 6, 7 in order to ensure the continuity of the electrolysis. On the other hand, the suction of the water which is introduced in circular tank 32 by the rotation of interiorly grooved conical part 23. After having cooled turbine 27 by its contact with central part 26, water 21 is transformed into steam 58 in pipes 31 in order to shoot onto the blades of turbine 30 which, connected with turbine 27 by fins 29 and ring 28, contributes to the rotation of the assembly; hollow shaft 19, armature 44. Thus, there is a complete transformation of the energy produced by the explosion and the combustion of the hydrogen and oxygen under pressure arriving at high speed, into electrical energy, since the mechanical power due to the explosion is transmitted to turbine 27, and the thermal energy /5
brought about by the combustion by the intermediary of the steam is transmitted to turbine 30. But before mixing in order to produce this mechanical energy due to the explosion and this thermal energy due to the combustion, the oxygen and hydrogen under pressure have acquired another energy produced by the high speed of movement of their molecules due to the difference in pressure, altitude and length of the journey between the bottom of the body of water where they are produced and the surface of the water where they are burned. Consequently, if all these energies are added, the sum is much greater than the energy necessary for electrolysis. If all the production elements supply their electrodes with d.c. current, there is production of hydrogen and oxygen under pressure for industrial users which is released by valves 41, 42. In contrast, if

one or two production elements are used in that way and all the others have their switch 55 tilted on studs 59, 60, a part of the electrical energy produced ensures the continuity of the electrolysis, and the majority is reserved for industrial use 47. The production elements are electrically connected together by cables 61, 62, Figure 2.

<u>Claims</u> /6

1. A device which makes possible the production of hydrogen and oxygen directly under pressure.

Characterized by the fact that the electrolysis of the water making this production possible takes place at great depth and uses the pressure predominating at this location for the compression of the hydrogen and oxygen.

2. A device making possible the storage of oxygen and hydrogen under pressure under water at great depth on production sites.

Characterized by the fact that for this purpose, diving bells are used as tanks, making possible a constant pressure and walls which are not very thick. This storage far from everything is safety factor.

3. A device making it possible to use the potential energy formed by a compressed gas in the ocean depths.

Characterized by the fact that one uses a storage bell connected to the surface by a pipe, which makes it possible to use the difference in pressure and altitude existing between the bottom and the surface of the water in order to move the molecules of the gas and accelerate this movement over the length of the ascending journey.

4. A device which makes it possible to transform the mechanical energy produced by the explosion of the hydrogen-oxygen mixture propelled from the ocean depths into a rotating movement.

Characterized by the fact that one uses the energy formed by the speed of propulsion of the two gases when they enter the combustion chamber in order to add this to the energy produced by the explosion of the mixture; the sum of these two energies brings about the rotation of a turbine which drives an electrical current generator.

5. A device which makes it possible to transform the thermal energy produced by the combustion of the hydrogen-oxygen mixture into a rotating movement.

Characterized by the fact that by centrifugation, water is propelled in pipes placed coming out of the combustion chamber; thus, by heating up, the water is transformed into steam which puts in motion a turbine which drives an electrical current generator.

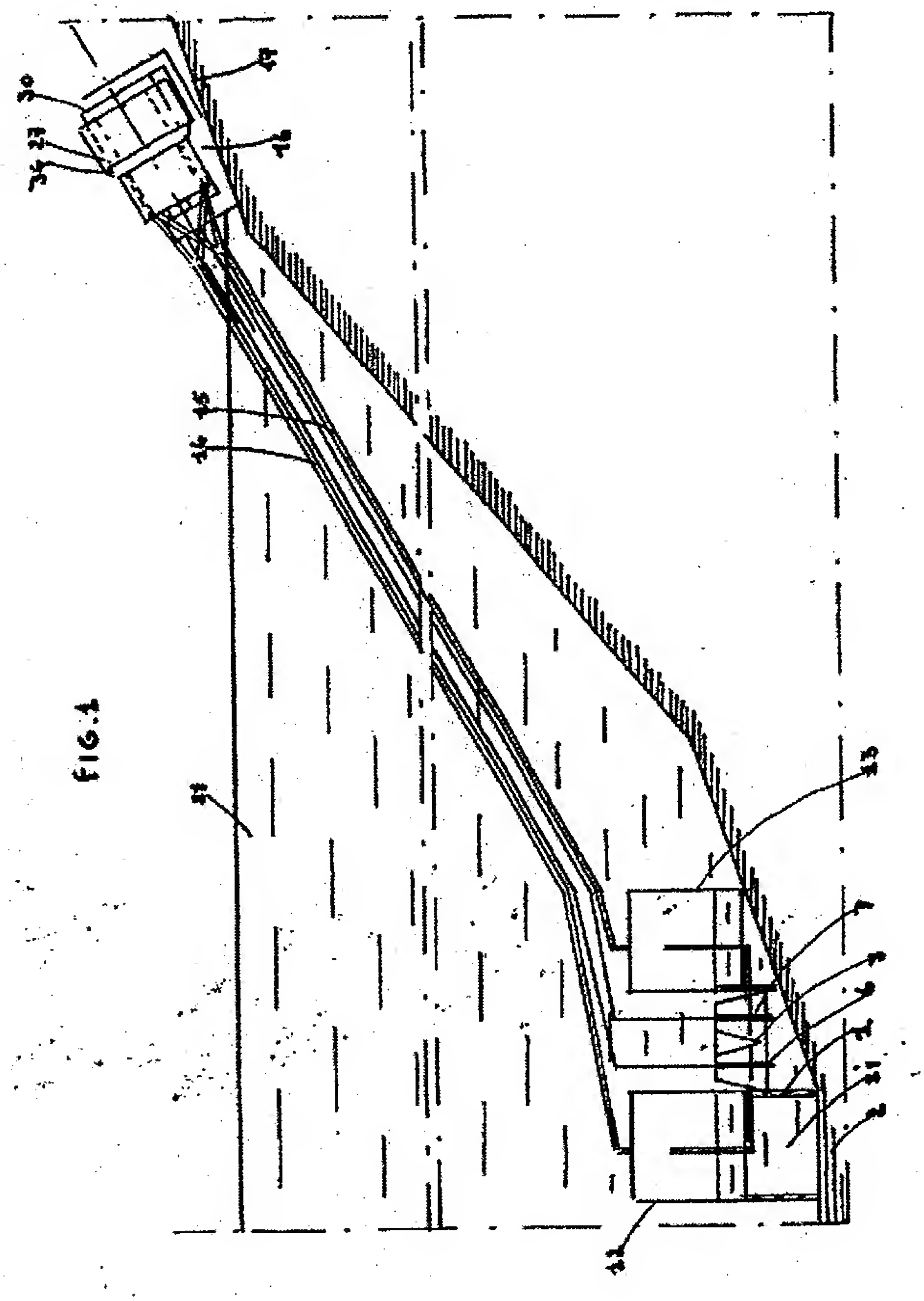

FIG.1

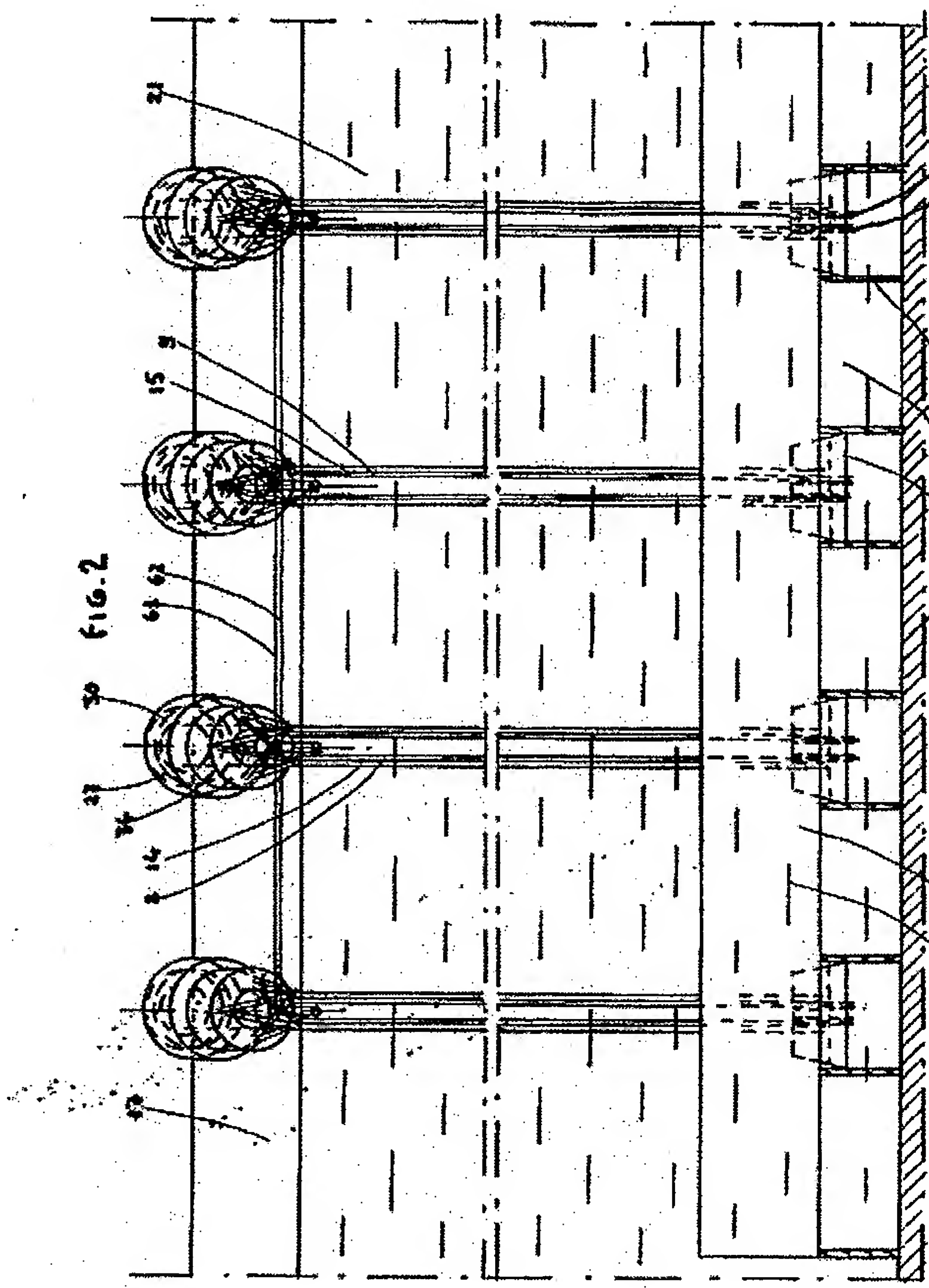

FIG. 2

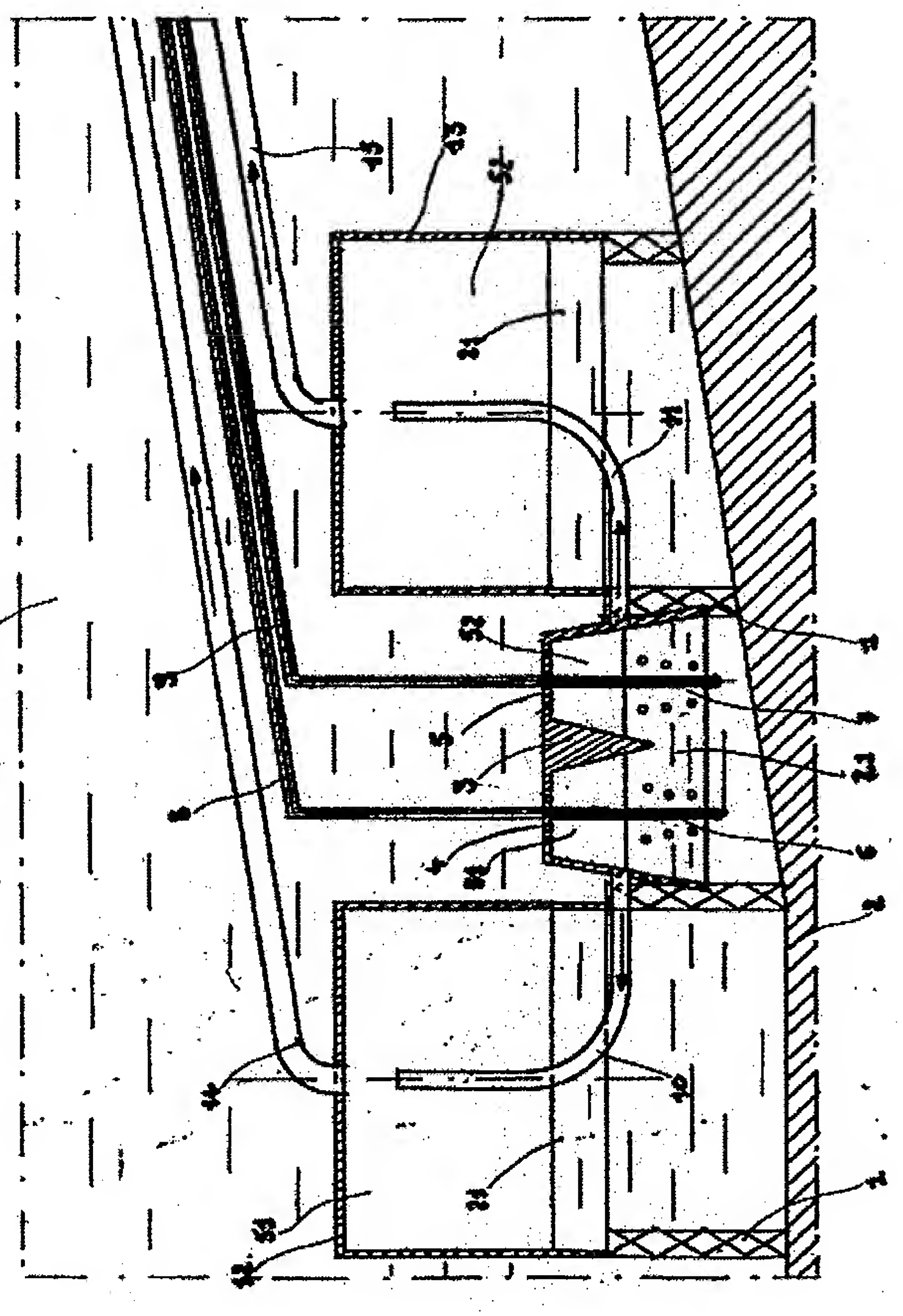

FIG. 3

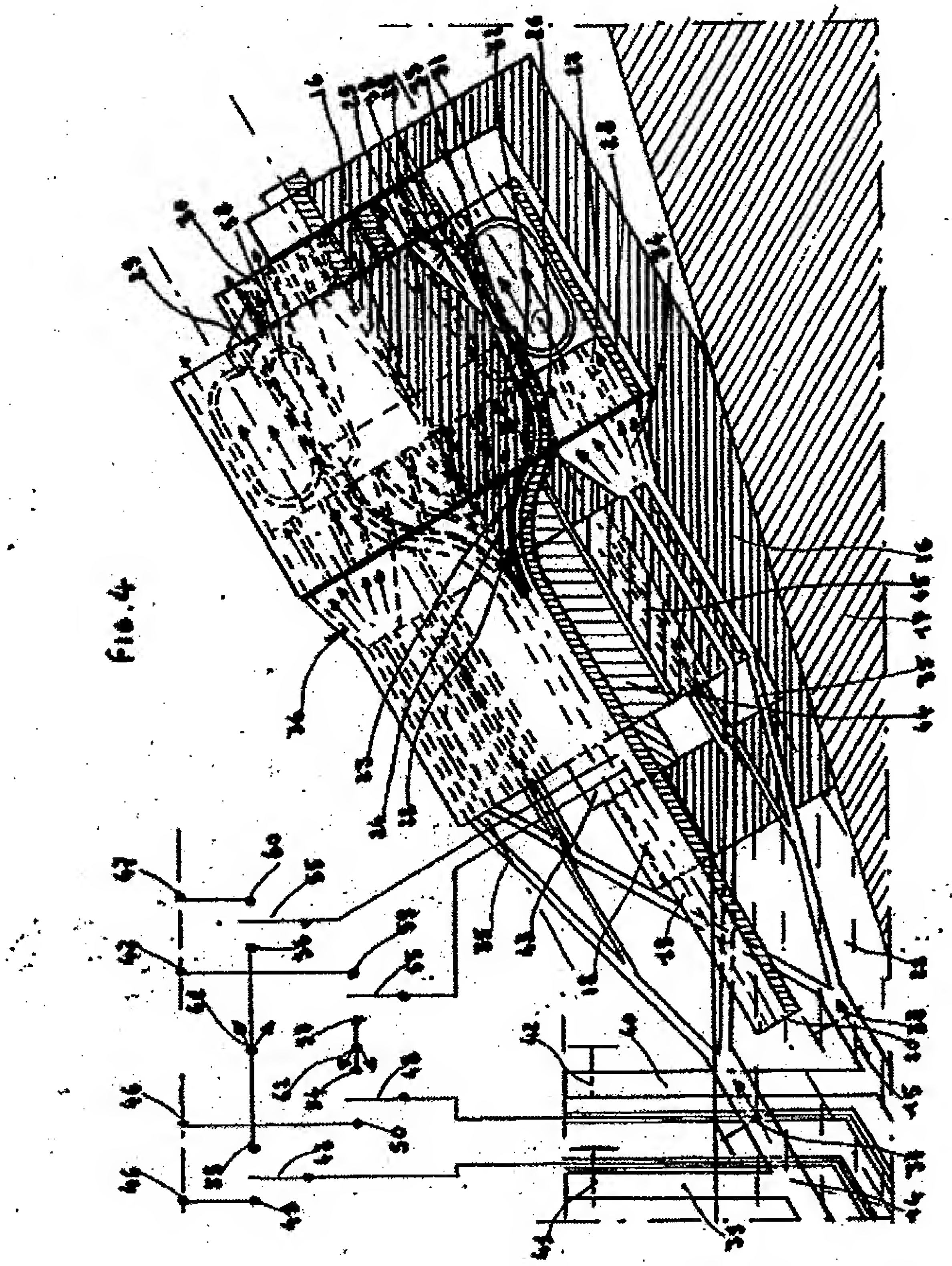

Fig. 4